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[54] **CONTINUALLY POSITIONABLE CHAIR WITH ADJUSTABLE LUMBAR SUPPORT**

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[52] **U.S. Cl.** **297/258**; 297/294; 297/383

[58] **Field of Search** 297/258, 299, 295, 296, 297/270, 239, 345, 451

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[57] **ABSTRACT**

The present invention provides a chair with a seat cushion thickened toward the front thereof, and thinned toward the rear, positioned on a support frame having a pair of legs extending down to a pair of curved rails which flair apart from one another toward the rear thereof. These rails extend forward sufficiently that the chair can be tilted forward along the rails on a horizontal surface until the top of the seat cushion slopes downward, and these rails extend rearward sufficiently such that the chair can be tilted rearward therealong until the seat cushion top again slopes downward. The backrest extending from underneath the cushion, and then upward therefrom, carries a cushion which is thickened toward the top thereof and thinned toward the bottom. This cushion is adjustably positionable up or down along the backrest to be available to be positioned against a user's lumbar region depending on the length of the user's back. The backrest may also be adjustable suitable forward and backward to fit the length of the user's legs between the pelvis and the back of the knees.

7 Claims, 1 Drawing Sheet

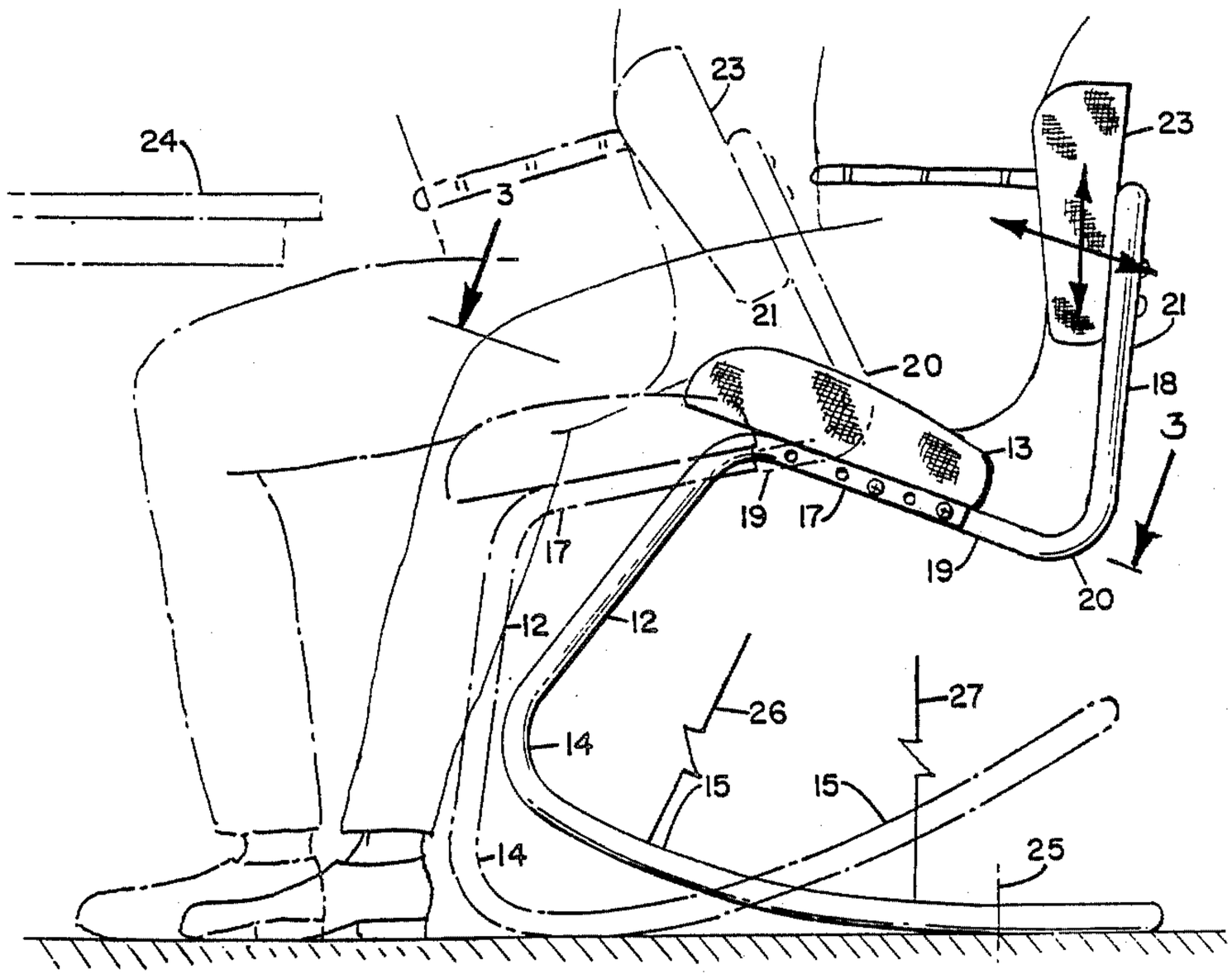
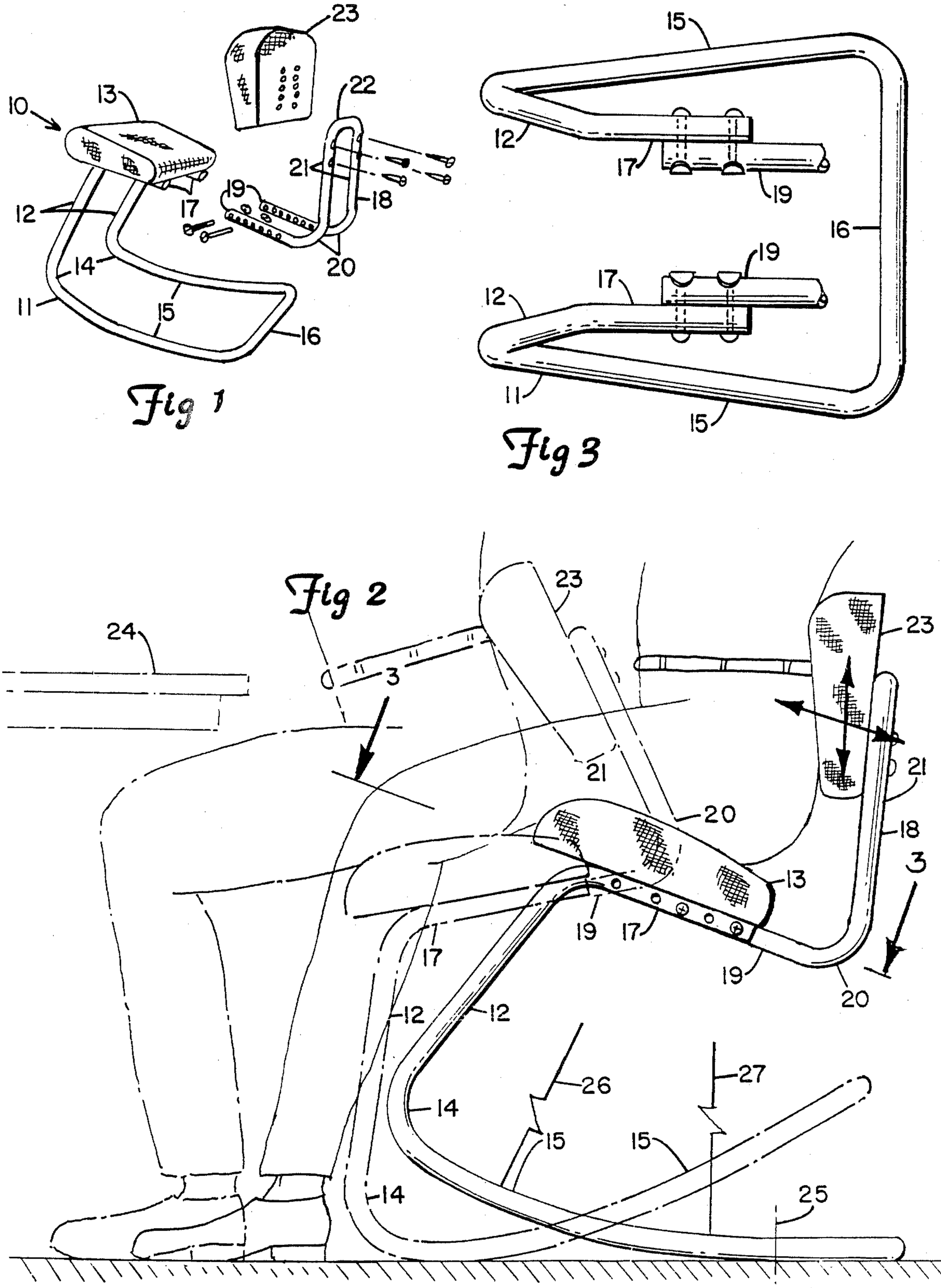


Fig 1

Fig 3

Fig 2



CONTINUALLY POSITIONABLE CHAIR WITH ADJUSTABLE LUMBAR SUPPORT

BACKGROUND OF THE INVENTION

The present invention relates to chairs which can be placed by the user in either task accomplishing positions or rest positions and, more particularly, to such positionable chairs which also position the spine and pelvic region of the user to reduce efforts required of associated muscles.

The posture taken by an individual while seated often determines the amount of strain occurring in the muscles associated with the spine and pelvis, and the fatigue that results. The posture may be poor, either because the chair in use forces the spine into unnatural positions or because the user slouches while sitting.

Typical chair backrest cushions often have a bulge on the user's side of thereof which is located at a relatively low position therealong with respect to the back, often just above the pelvic area. Such cushion bulges block the movement of the supraspinous ligament and several of the vertebral segments. Rearward movement of these segments is necessary for achieving proper equilibrium in the spine of one sitting on a chair in an upright position in accomplishing tasks in front of them. Because such spinal movement is blocked, the center of gravity of the body is kept too far forward leading to a moment about the ischium of the seated pelvis which must be compensated for by various spinal muscles continually contracting.

On the other hand, many chairs do not permit the user to also recline somewhat with the spine tilted significantly backward for purposes of resting, a decided help since rearward inclination of the back on an inclined backrest permits the backrest to support up to half the weight of the upper torso. An inability to incline backwards to permit the chair backrest to take up some of the upper torso weight leaves only the back muscles to continually support such weight.

In doing tasks in an upright sitting position, a user of a chair will have a desire to be tilted relatively forward of, or backward from, some usual task-accomplishing position, and at varying angles. The desired changes from this usual upright position will depend on the particular portion of the task being undertaken. Also, the usual position taken for accomplishing tasks will depend on the task, the length of the person's legs and arms, etc. The ability of the user to adjust his upright position continually at his or her desire to a selected degree will be less tiring for that person if such adjustments can be made while minimizing any efforts which involve having to shift position with respect to the chair, or involve having to move the chair along the horizontal surface on which it rests.

Thus, there is desired a chair which fully supports the natural lumbar lordotic curve of the lower spine of a user in most upright positions and in any reclining positions, the chair being able to permit the user to conveniently attain all such positions. Further, the chair should be able to change between various upright positions easily, and to change between upright positions and reclining positions easily.

SUMMARY OF THE INVENTION

The present invention provides a chair with a seat cushion thickened toward the front thereof, and thinned toward the rear, positioned on a support frame having a

pair of legs extending down to a pair of curved rails which flair apart from one another toward the rear thereof. These rails extend forward sufficiently that the chair can be tilted forward along the rails on a horizontal surface until the top of the seat cushion slopes downward, and these rails extend rearward sufficiently such that the chair can be tilted rearward therealong until the seat cushion top again slopes downward. The backrest extending from underneath the cushion, and then upward therefrom, carries a cushion which is thickened toward the top thereof and thinned toward the bottom. This cushion is adjustably positionable up or down along the backrest to be available to be positioned against a user's lumbar region depending on the length of the user's back. The backrest may also be adjustable forward and backward to fit the length length of the user's legs between the pelvis and the back of the knees.

The support frame may be formed of a single tube with the rails having been formed by compound curves. The curvature toward the front of the rails is sharper to permit easy rocking forward, but is less curved toward the rear to permit a slower backward tilt into a reclining position.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows a partially exploded view of the present invention,

FIG. **2** shows the chair with a user in two possible positions, and

FIG. **3** shows a cross section view of a portion of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. **1** shows a partially exploded view of that chair, **10**, forming the present invention. A continuous tubular frame, **11**, is shown formed by a single tube which has been bent to the shape shown. Tubular frame **11** has a pair of chair support legs, **12**, affixed to the bottom of a seat cushion, **13**. Legs **12** extend downward at about 60°, and so somewhat forward, from seat cushion **13** to where the tube from which they are formed is sharply bent at a pair of corresponding bends, **14**. Leaving bends **14**, the remaining portions of tubular frame **11** serve as a pair of corresponding curved rails, **15**, joined by a rear cross-connecting portion, **16**. Legs **12** are affixed to the bottom of seat cushion **13** by a portion of each end of the tube forming frame **11** which are a relatively sharply bent over from support legs **12** to form a pair of seat cushion supports, **17**.

Cushion supports **17** have holes therethrough parallel to the horizontal surface on which chair **10** rests which match holes in a backrest tubular frame, **18**, formed by another single tube bent to the shape shown, these matching holes being located in fastening portions, **19**, thereof. Fastening portions **19** are formed in this tube by its two end portions formed parallel to one another. By positioning fastening portions **19** of tubular frame **18** either relatively back or forward parallel to portions **17** of tubular frame **11**, tubular frame **18** may be fastened either closer to or further away from the rear facing end of seat cushion **13**. This allows a user of chair **10** to adjust the backrest of which tubular frame **18** is a part to get it closer to or further from seat cushion **13**. This adjustment capability permits accommodating differing lengths of the legs of different users between the pelvis and the back of the knees.

Tubular backrest frame **18** has a corresponding pair of relatively sharp bends, **20**, leading upward from fastening portions **19** so that the remainder thereof forms a pair of backrest cushion mounting portions, **21**, which are joined together again by a top, cross-connecting piece **22**. Through holes provided in backrest cushion mounting portions **21**, fasteners can be inserted into the back of a backrest cushion, **23**, in any of the holes in the pair of corresponding vertical sequence sets of holes provided therein. Thus, cushion **23** can be adjusted up and down with respect to backrest cushion mounting portions **21**, and so with respect to the upper, or seating, surface of seat cushion **13**. This adjustment capability permits selecting a position for backrest cushion **23** with respect to seat cushion **13** for the dimensions of a particular user so that backrest cushion **23** can be placed to support the lumbar region of the user, and so reinforce the natural lordotic curve of that user's back.

FIG. **2** shows a user in the chair having moved chair **10** into two of the alternative positions possible with this chair, a forward, task accomplishing position shown in dashed lines and a rearward, rest position shown in solid lines. An indication of a cross section view of the rearward position is provided in FIG. **2**, this view being provided in FIG. **3**. As can be seen in FIG. **3**, rails **15** flare outward from one another toward the rear, reaching the greatest separation from one another where each is joined by cross-connecting portion **16**. This outward flaring provides increased side-to-side stability so that a user reclining rearward can do so confidently without anxiety as to the resulting reduced control of the user's stability in that position. Such a reduction in stability control results because the user's legs are no longer positioned, if the user is tilted rearward, to be as capable of permitting the user to recover by placing a foot on the supporting floor to retain balance should any turning, twisting or leaning upset the user's stability.

The fasteners shown in FIGS. **1** and **3** joining seat cushion supports **17** of frame **11** with fastening portions **19** of frame **18** are threaded bolts which fit into threaded nuts each having a flange thereon adapted to the curvature of fastening portions **19**. The fasteners shown in FIG. **1** used for fastening backrest cushion **23** to backrest cushion mounting portions **21** are typically threaded bolts fitting into threaded inserts embedded in the back of cushion **23**.

Returning to FIG. **2**, the arrows shown there superimposed on backrest cushion **23** in the rearward position view show the directions that this cushion can be effectively adjusted to accommodate the physical dimensions of the user of chair **10**. The arrows shown pointing upward to the left and downward to the right are the direction of adjustment available by shifting fastening portions **19** with respect to seat cushion supports **17**. The arrows pointing opposite ways along the vertical show the directions backrest cushion **23** can be adjusted with respect to backrest cushion mounting portions **21**.

In the forward position in FIG. **2**, shown in dashed lines as noted above, the user has positioned the chair forward along rails **15** and, in doing so, has moved his body closer to the work surface arrangement, **24**, shown in the figure. Rails **15** are formed with the tube portions of frame **11** used therefor each being bent to follow a compound curve with a shorter radius of curvature, or a sharper curvature, present in the forward portion of rails **15**. This allows the user to move chair **10** in forward positions relatively rapidly and easily either forward or backward along rails **15** to thereby shift the user's body closer or further from work surface **24**. That is, the user can find a comfortable, usual position for the task at hand somewhere along the forward portion of rails **15**, but can make sensitive position adjustments thereabout for any portions of the task requiring somewhat different positioning both quickly and easily merely by straightening or bending the user's legs. Rails **15** extend forward sufficiently before encountering bends **14** so that the bottom surface of seat cushion **13** can be inclined downward to the left by about 10° with respect to the horizontal surface on which chair **10** rests.

On the other hand, in the rearward position shown in solid lines, the user has tilted his upper torso and chair **10** backward so that rails **15** move from contacting the horizontal surface on which chair **10** rests near forward portions thereof to contacting this surface at more rearward positions. Some distance toward the rear from legs **12**, i.e. past the forward portions of rails **15**, these rails are formed following the compound curve having an increased radius of curvature, i.e. the curvature is reduced, so that the ease and rate of tilting backward is decreased. This contributes to the user's feeling of stability in moving backward by slowing his rate of rearward movement for a given leg force.

Finally, the contact points of rails **15** reach a portion therealong which has no curvature at all to thereby stop rearward motion at a stable location. This portion occurs to the right of a vertical dashed line, **25**, shown in the rearward position view of FIG. **2**. In this position, the bottom surface of seat cushion **13** is inclined downward to the right at about 20° with respect to the horizontal surface on which chair **10** rests. The mounting, or rear, surface of backrest cushion **23** in this position has a clockwise angle from this surface of approximately 120°

Indications of the relative radii of curvature for the two portions of rails **15** toward the front of chair **10** from vertical dashed line **25** are also shown, a shorter radius, **26**, being indicated at the furthest forward position of rails **15**. A longer radius of curvature, **27**, is indicated along rails **15** at the portions thereof immediately forward of vertical dashed line **25**.

Seat cushion **13** is shown thickened toward the end thereof facing forward compared to the relatively thin structure it has toward the end thereof facing rearward. Thus, the user in a forward position, such as the one shown in dashed lines in FIG. **2**, is supported on a thickened portion of cushion **13** providing a structure which keeps the user from sliding forward on cushion **13**, and so reduces the user's risk of falling off chair **10** in that position. Cushion **23** has a top edge thereof still in contact with the user's back to provide some support, and to prevent slouching, in this forward, task-accomplishing position.

In the rearward position shown in solid lines in FIG. **2**, the thickened upper portion of cushion **23** near the upward facing end, properly positioned, is firmly in contact with the lumbar region of the user's back. The thinner bottom portion of cushion **23** near its downward facing end, along with the thinner rear portion of cushion **13**, allows room for the pelvis of the user to rotate slightly in a clockwise direction while the thicker upper portion of cushion **23** continues to support the lumbar region of the user. This slight rotation of the pelvis places the center of gravity of the user's upper torso over the ischium and thereby relieves the associated

muscles of having to overcome any moments about the ischium leading to fatigue as the spine now follows the natural lordotic curve. This positioning of the spine is assured by having the angle between the straight portions of seat cushion supports **19** and backrest cushion supports **21** being approximately 75°, and with having the user-contacting surfaces of each of cushions **13** and **23** being inclined at approximate 7.5° to the back surfaces of these cushions where supported by the tubular frames **11** and **18**, respectively. This combination of angles leaves approximately a 60° angle between the user-contacting surfaces of cushions **13** and **23** as is desired for supporting the natural lordotic curve of the user's back.

Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.

What is claimed is:

1. A continually positionable chair, positionable between a rear rest position and selected forward positions suited to a user's task, and with a backrest providing support to a user's lumbar region if said chair is positioned near said rear rest position, said chair comprising:

a seat cushion having a base surface separated from a seating surface by a greater amount at locations toward its front facing end than at locations near its rear facing end;

a support frame, attached to said seat cushion base surface, having a pair of legs extending away from said seat cushion base surface and supported by a pair of non-parallel, curved rails spaced further apart from one another toward rear portions thereof than they are toward front portions thereof, said rails extending forward sufficiently such that said chair can be tilted forward therealong on a horizontal surface until said seat cushion base surface slopes downward, and extending rearward sufficiently that said chair can be tilted rearward therealong until said seat cushion base surface again slopes downward; and

a backrest having a backrest frame extending from said seat cushion base surface to curve upward, and having a backrest cushion with a back surface separated from a support surface thereof by a greater amount at locations near its upward facing end surface than at locations near its downward facing end surface, said backrest cushion being adjustably attached to said backrest frame such that said backrest cushion can be adjusted upwardly and downwardly along said backrest frame within a selected range so that it may be positioned to support a user's lumbar region.

2. The apparatus of claim **1** wherein said backrest frame is adjustably attached at said seat cushion base surface such that it can be moved therealong forwardly and rearwardly within a selected range to accommodate that length occurring between a user's knees and pelvic region.

3. The apparatus of claim **1** wherein said support frame is formed of a single piece of tubing so that rear locations of said rails are joined together.

4. The apparatus of claim **1** wherein each of said rails follows a compound curve having at least two different radii of curvature with a forward portion of each of said rails curving such as to follow a line hving a curvature which can be approximated by a circle having a shorter radius of curvature than that approximating a rearward portion in each of said rails.

5. The apparatus of claim **2** wherein said pair of legs extends away from said seat cushion base surface at locations near said seat cushion front facing end.

6. The apparatus of claim **4** wherein each of said rails has a portion at its extreme rear which follows a straight line.

7. The apparatus of claim **6** wherein each of said rails follows a compound curve having at least two different radii of curvature with a forward portion of each of said rails curving such as to follow a line having a curvature which can be approximated by a circle having a shorter radius of curvature than that approximating a rearward portion in each of said rails.

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